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USE OF METALLIC ENDOSSEOUS IMPLANTS AS A TOOTH SUBSTITUTE

Annual Report

Marvin B. Weiss, D.D.S., William Rostoker, Ph.D.

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USE OF METALLIC ENDOSSEOUS IMPLANTS AS A TOOTH SUBSTITUTE

INTRODUCTION:

OBJECTIVE

The objective of the study is to evaluate the viability of an artificial metallic prosthesis as a tooth replacement when placed permanently into the jaw bone. The tooth substitute consists of two parts; (1) the root portion, a metallic implant with an open-pore system of sintered metallic fiber aggregate attached to a solid metal rod; and (2) a crown portion; the portion of metal rod that extends into the oral cavity. The root portion is buried in the bone of the mandible or maxillae and the crown portion is exposed in the oral cavity and placed in function with the opposing dentition.

BACKGROUND

The development of a dental implant that will serve as a permanent tooth replacement began in 1969 with the use of mongrel dogs as the experimental animal⁽¹⁾. Later studies were performed in female baboons⁽²⁾. The animal studies and initial studies in humans are summarized in the last annual report⁽³⁾ for an earlier contract with the US Army Medical Research and Development Command, Contract No. DADA17-70-C-0114.



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PROGRESS REPORT

The last contract year was spent in testing the dental implant as a single tooth replacement. The ultimate goal of this implant study was to develop a free-standing single tooth replacement.

MATERIALS AND METHODS: HUMAN STUDY (SINGLE TOOTH REPLACEMENT)

Volunteer patients were selected who had a full dentition except for one posterior tooth missing and there had to be a natural tooth on each side of the edentulous area. The patients were screened and selected on the same basis described for the implant bridge patients.² The total experiment was explained to the patient in great detail and they were required to read and sign an informed consent form.

SURGICAL PROCEDURES

The dental implant was inserted into the edentulous area using the exact procedures as described for implant bridges in a previous report⁽³⁾. The only modification was increasing the length of the shank of the bur because the edentulous area was not as readily accessible due to natural teeth being present on each side of the implant site. A plastic sleeve on the shank of the bur limited its penetration into the bone to only the desired depth.

PROSTHESIS

In all cases, the dental implant was in place for at least a month before the crown was cemented to the implant and placed in function with the opposing dentition. All crowns were ceramco crowns (porcelain fused to gold). The crowns were designed to have wide embrasures so that oral hygiene was more easily accomplished. It was attempted to create normal contacts with the adjacent natural teeth. These contacts were not always

PROSTHESIS CON'T

ideal because of the position of the natural teeth and the angle of the implant post. The patients were examined every month after the crowns had been placed in function and the state of the implant recorded by x-rays and photographs.

Aver 2,000 prospective volunteers were screened and over 250 patients were examined. Fifty-five patients were selected and given the final screening; study models and x-rays, etc. Thirty-eight patients have received implants and twenty-seven crowns have been placed in function. Nine implants have been lost prior to crowns being placed.

CLINICAL STUDY 1978-79

The goal for the current year's contract was to test the use of the dental implant as a support for a complete lower over-denture and a mandibular removable partial denture.

Ten patients will be treated by having four dental implants placed in edentulous mandibles to support a lower over-denture. The edentulous patients will have new dentures made. The dentures are adjusted so that the patient can masticate as well as possible. Four dental implants will then be inserted in the edentulous mandible in the areas of teeth #18, 23, 27 and 30. The denture will be modified so that the implant posts will fit inside of the denture material with no contact. This accomplished by using a clear plastic tray made over a stone model of the edentulous mandible. Openings in the guide tray mark the position of the implant posts. These areas are marked on the inside of the denture and openings made to accomodate the implant posts. After the implants have been stabilized for a minimum of four weeks, an impression of the mandible with the implant posts is taken and epoxy model made.

CLINICAL STUDY CON'T

The laboratory makes parallel gold copings to fit over the implant posts. These are then cemented onto the implants in the mouth. The implant post holes in the denture are enlarged to accomodate the copings. After the copings are lubricated, quick cure denture material is placed in the denture holes. While still very plastic the denture is inserted into the mouth and held in centric occlusion by the upper denture until the material sets. The excess denture material is removed and the lower denture should now be stable because of the close fit between the copings and the denture. The patient will be examined, implants photographed and x-rayed every month for one year and every six months for the next four years.

Approximately twelve patients will have implants used as stabilizers for free-end removable mandibular partial dentures. Each patient will have two implants, one in the area of #18 and one in the area of #31. The implants will be placed and after a healing period of at least one month, impressions will be made for construction of the partial dentures. The metallic framework will include clasping natural teeth plus a removable attachment to the dental implants. The patients will be examined each month for the first year with x-rays and photographs of the implants and every six months for the next four years.

The goals have been delayed because of the severe winter conditions that prevented patients appointments for almost four months. As a result an extension of this year's contract was approved moving the termination date to September 30, 1979. It is anticipated that all patients will be completed by that date.

STATUS OF HUMAN IMPLANT CLINICAL STUDY AS OF JUNE, 1979

The human studies are divided into three phases; the first experiment was the use of the dental implant as a distal abutment for a fixed bridge in which the mesial abutment was a natural tooth; the second experiment was the use of the dental implant as a free-standing implant supporting a functioning crown and the third study, the use of the dental implant to support an over-denture and removable partial denture.

In the first study, twenty-five dental implants were inserted. One implant was lost after 21 days due to an improper implant size. Two implants were used in one fixed bridge. A total of twenty-three fixed bridges were constructed. Six of these bridges have been lost due to the following causes:

1. Loss due to traumatic occlusion after 27 months.
2. Loss due to loose implant wire after 24 months.
3. Loss due to broken implant bridge after eight months.
4. Loss due to periodontally involved natural tooth after six months.
5. Loss due to traumatic occlusion after 23 months.
6. Loss due to traumatic occlusion after 40 months.

The success rate of the functioning bridges is 74 percent. The remaining bridges are examined every six months. All implants have been in for over 40 months and up to 47 months. Clinical examinations and x-rays show no deterioration of bony support or clinical signs of inflammation at this time.

In the second study, thirty-eight dental implants were inserted. Twenty-five crowns were placed on the implant posts in function. All the implants have been in place for 22 months. Fifteen implants have been removed, only five had been crowned and in function. Those implants removed had been in place from three to nine months prior to removal.

STATUS OF HUMAN IMPLANT CLINICAL STUDY CON'T

The causes of the implants removal were increased mobility and x-ray findings of increased bone loss. There was suppuration in two cases. The pain associated with the mobility of the implant was minimal and ceased immediately following the removal of the implant. Removal was accomplished under local anesthesia with no post-operative pain or discomfort. In all cases, healing was rapid with excellent closure of the soft tissue.

This report shows a 80 percent success rate for the free-standing single crowned tooth replacement. Most of the losses can be attributed to poor technique in inserting the implant in restricted edentulous areas. Also in two cases the implant was placed in an area where a deciduous tooth had been removed 30 days prior to surgery.

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^aUS Army Medical Research and Development Command, Fort Detrick, Frederick, MD 21701.

^bNational Technical Information Service (NTIS), Springfield, VA 22314.

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Reports on the research have been published in the following journals:

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